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THE "GIST" OF FOUR YEARS' SOIL INVESTIGATION IN THE ILLINOIS CORN BELT.

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Nitrogen.

At ordinary commercial prices the nitrogen contained in the air above each acre is worth more than ten million dollars. By means of bacteria which live on their roots, clover and other legumes have power to draw on this unlimited supply of free nitrogen.

Potassium.

The ordinary, naturally well surface-drained land of the Corn Belt in Central and Northern Illinois contains in the soil of one acre to a depth of seven inches sufficient total potassium for a hundred bushels of corn each year for 1900 years, if the stalks are returned to the land directly or in manure. The supply is about 36,000 pounds and one hundred bushels of corn (grain only) contain 19 pounds of potassium. Potassium may be liberated from the soil as needed, by means of decaying organic matter, such as farm manure, clover residues, and legume catch crops as green manures.

TABLE 1. CROP YIELDS IN SOIL EXPERIMENTS: BLOOMINGTON FIELD: COMMERCIAL NITROGEN SERIES.

Typical Corn Belt Soil: Brown Silt Loam Prairie of the Early Wisconsin Glaciation.

Plant Food Applied.	1902 Corn, bu.	1903 Corn, bu.	1904 Oats, bu.	1905 Wheat, bu.
None	37	60	61	29
Nitrogen	35	60	70	31
Phosphorus	42	73	73	39
Potassium	38	56	63	33
Nitrogen, phosphorus	44	78	85	51
Nitrogen, potassium	40	59	66	30
Phosphorus, potassium	50	75	70	38
Nitrogen, phosphorus, potassium	53	81	91	52
Average gain for nitrogen	1	4	11	6
Average gain for Phosphorus	10	18	15	14
Average gain for potassium	6*	0	0	1
Average gain for phosphorus when added to nitrogen	11	20	20	21
Value of this increase	$3.85	$7.00	$5.00	$14.70

Approximate Cost of 25 Pounds of Phosphorus.

In rock phosphate	$ .80
In steamed bone meal	2.50
In acid phosphate	3.20
In "complete fertilizer"	8.00

*Potassium is applied as a soluble, corrosive salt which, like common salt, sometimes acts as a stimulant and thus liberates some phosphorus or nitrogen from the soil.

TABLE 2. CROP YIELDS IN SOIL EXPERIMENTS: URBANA FIELD: THREE-YEAR ROTATION: LEGUME SERIES.

Typical Corn Belt Soil: Brown Silt Loam Prairie of the Early Wisconsin Glaciation.

Soil treatment applied.	Corn. 3 yr. av., bu.	Oats. 2 yr. av., bu.	Clover. 2 yr. av., tons.
None	77	48	1.65
Legume (catch crops)	77	51	1.69
Legume, lime	78	56	1.70
Legume, lime, phosphorus*	89	67	2.47
Legume, lime, phosphorus, potassium	91	68	2.82
Gain for legume	0	3	.04
Gain for lime	1	5	.01
Gain for phosphorus	11	11	.77
Gain for potassium	2	1	.35

Value of Increase and Cost of Treatment.

	Corn.	Oats.	Clover.	Total for 3 years.	Cost for 3 years.
For legume	$ .00	$ .75	$ .20	$ .95	$ (?)
For lime	.35	1.25	.05	1.65	1.50
For phosphorus	3.85	2.75	3.85	10.45	7.50*
For potassium	.70	.25	1.75	2.70	7.50†

*$7.50 supplies 75 pounds of phosphorus in steamed bone meal. The three crops have removed only 43 pounds of phosphorus.

†$7.50 supplies 120 pounds of potassium. The three crops have removed 194 pounds of potassium.

NOTE.—On the field where a catch crop of clover was seeded in the corn in 1902 oats and clover were seeded in 1903 by "disking in," without plowing; but the old clover still grew and smothered out the oats and the young clover. Hence we give the average of only two years' results from oats and clover with three years' from corn.

Phosphorus.

If we could draw at will upon the total phosphorus in the first seven inches of soil the supply (about 1200 pounds) would be entirely exhausted to that depth during the lifetime of one man, if hundred-bushel crops of corn were taken from the land. A hundred-bushel crop of corn requires seventeen pounds of phosphorus for the grain and six pounds for the stalks. Oats, wheat, and clover also draw heavily upon phosphorus. When crops are fed the animals store in their bones about one-fourth of the phosphorus contained in the food consumed.

By means of decaying organic matter we can liberate each year a small percentage of the phosphorus in the soil. If we need more than we can profitably liberate from the soil, we should apply it in the cheapest and most natural form, preferably as steamed bone meal or as finely ground raw rock phosphate in connection with manure or clover. Steamed bone meal is really a farm product and raw rock phosphate is a natural plant food material, and neither will ever injure the soil. The use of acidulated manufactured fertilizers is not advised.

Results.

On the Bloomington experiment field for the three years, 1903, 1904, and 1905, we applied, in all, 300 pounds per acre of commercial nitrogen at 16 cents a pound, 75 pounds of phosphorus at 10 cents a pound, and 120 pounds of potassium at 6¼ cents a pound. We removed from the best yielding plot, in the three crops, corn, oats, and wheat, 287 pounds of nitrogen, 45 pounds of phosphorus and 176 pounds of potassium, per acre. Measured by the crop yields, we have gained (on the best yielding plot) 13 pounds of nitrogen and lost (as an average of four plots) $39.65 of the $48 invested in dried blood; we have gained 30 pounds of phosphorus and have also gained $12.35 in money above the $7.50 invested in steamed bone meal; and we have lost 56 pounds of potassium more than we applied and we have also lost $6.80 of the $7.50 invested in potassium.

For more detailed information regarding methods of soil improvement, cost and methods of applying plant food materials, comparative value of steamed bone meal and raw rock phosphate, systems of crop rotations, the use of legume catch crops, etc., see Circulars 87, 96, and 97, which will be sent free of charge upon request.

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